Chapter 2

Airport Development

2.1 Delay and the Need for Airport Development

Delay decreased a significant amount in 1991 over the previous year. As a result of the war in the Persian Gulf and the overall weakness of the economy, total aircraft operations declined, and the drop in flight operations resulted in fewer delays. However, air transportation has become a vital part of the U.S. economy. As the economy recovers, the demand for air travel will grow, and the number of aircraft operations will increase to meet that demand. Current forecasts indicate that, with the recovery of the economy and absent any capacity improvements, delays will increase substantially over the next decade, though at a somewhat slower pace than in the 1980s.

Delay decreased a significant amount in 1991 over the previous year as a result of the war in the Persian Gulf and the overall weakness of the economy. With the recovery of the economy and absent any capacity improvements, delays will increase substantially over the next decade.

Preliminary results of a survey conducted by the FAA's Office of Airport Planning and Programming, National Planning Division, indicate that, with the new improvements planned, capacity at the majority of the 29 "large hub" commercial service airports in the U.S. will be adequate to meet the forecast growth in demand. The few problem airports, which are predicted to continue to experience significant delays despite planned improvements, are primarily the large metropolitan area airports on the east and west coasts, principally in the Northeast and in California. At these problem airports, planned improvements are not adequate, to meet the projected growth in demand, for a variety of reasons.

The positive message contained in the preliminary results of this survey is that the capacity needed to meet future demand will be available at most of the Nation's busiest airports, if the improvements planned for these airports continue to be funded and built. It is, therefore, essential that the aviation community, in both the public and private sectors, continues to work together to ensure that these improvement projects are completed in time to meet the growth in demand.

However, this survey also points out that, even though capacity improvements are planned at the few delay-problem airports, they will not be enough to meet forecast demand at these airports. Delays there will most likely increase as demand increases. If the demand for air transportation in these large metropolitan areas cannot be met by the existing major airports in these areas, then other airports must be developed within the region to avoid severe constraints on air traffic growth.

From this perspective then, airport capacity improvements take on a two-tiered scheme of priorities. For most of the airports in the country, the need for capacity improvement must continue to be emphasized so that projects will continue to be planned, funded, and built to keep pace with the projected increases in demand. This has been the work of the Airport Capacity Design Teams, which is described in more detail in this chapter.

For most of the airports in the country, the need for capacity improvement must continue to be emphasized so that projects will continue to be planned, funded, and built to keep pace with the projected increases in demand.

For the few delay-problem airports in the Northeast, in California, and elsewhere, renewed emphasis must be given to finding innovative solutions beyond the airports themselves. New airports, expanded use of existing commercial-service airports, civilian development of former military bases, and joint civilian and military use of existing military facilities will be discussed in this and subsequent chapters. These options and more must be explored systematically with a view toward developing a multiple airport system within the local region to serve the expanding air transportation needs of these large metropolitan areas.

For the few delay-problem airports, renewed emphasis must be given to finding innovative solutions beyond the airports themselves.

2.2 New Airport Development

The largest aviation system capacity gains result from the construction of new airports. The new Denver airport, for example, not only will increase capacity and reduce delays in the Denver area but also will reduce delays throughout the aviation system. However, at a cost of over $2.9 billion for a new airport like Denver, it will remain a challenge to finance and build others. In addition, the development of new airports faces environmental and other constraints. Table 2-1 summarizes major new airports that are under construction or are under consideration in various planning studies by state and local government organizations. New Denver is the only major new airport currently under construction.

The largest aviation system capacity gains result from the construction of new airports.

Table 2-1. Major New Airports — Under Construction and Planning Studies

Airport	Purpose	Status
New Denver	Replacement airport for Denver Stapleton (DEN), which will close.	Under construction. Scheduled to be operational late 1993.
Dallas-Ft. Worth	Supplemental airport.	Phase 2 satellite study by North Central Texas Council of Governments.
Minneapolis-St. Paul	Replacement airport for MSP. Proposal is to close existing airport.	Dual track. Feasibility study for new airport. Capacity enhancement study for existing airport.
New Orleans	Replacement airport for MSY. Existing airport will remain in operation.	Phase 2 site selection study, investigating airspace at four possible sites.
Chicago	Supplemental airport.	Under study. No Regional Airport Commission legislation.
Seattle-Tacoma	Supplemental airport.	Satellite study by Port of Seattle and Puget Sound Regional Council recommended a multiple airport system for region.
Boston	Supplemental airport.	Satellite study by Massport and Council of Governments.
Atlanta	Supplemental airport.	Satellite study by Atlanta Regional Commission of non-ranked sites. Feasibility study by State of Georgia.
Northwest Arkansas	Replacement airport for Fayetteville (FYV), which will remain in operation.	Site selection/AMP/EIS underway. Feasibility study completed.
Birmingham, Alabama	Replacement airport. Proposal is to close existing airport.	Site selection completed. Ranked sites and preferred sites identified by State of Alabama.
North Carolina	All-cargo airport.	Sites ranked by State of North Carolina.
Eastern Virginia	Supplemental airport.	Regional study by three Councils of Governments.
Louisiana	Intermodal facility. Replacement airport for MSY and Baton Rouge (BTR). Existing airports will remain in operation.	New airport feasibility study by State of Louisiana. Regional Airport Commission appointed by State of Louisiana.
Austin	Replace Robert Mueller Airport.	Conversion of Bergstrom AFB to civil use.
Phoenix	Regional airport.	Feasibility study underway for Phoenix/Tucson regional airport.
San Diego	Supplemental airport.	Feasibility study underway for joint US/Mexican airport in Otay Mesa area.

2.3 Development of Existing Airports — Airport Capacity Design Teams

As environmental, financial, and other constraints continue to restrict the development of new airport facilities in the U.S., an increased emphasis has been placed on the redevelopment and expansion of existing airport facilities. Since 1985, the FAA has co-sponsored Airport Capacity Design Teams at airports across the country affected by delay. Airport operators, airlines, and other aviation industry representatives work together with FAA representatives to identify and analyze capacity problems at each individual airport and recommend improvements that have the potential for reducing or eliminating delay.

Aircraft flight delays are generally attributable to one or more conditions, which include weather, traffic volume, restricted runway capability, and NAS equipment limitations. Each of these factors can affect individual airports to varying degrees, but much delay could be eliminated if the specific causes of delay were identified and resources applied to develop the necessary improvements to remove or reduce the deficiency.

Since the start of the program, 26 Airport Capacity Design Team studies have been completed. Currently, eight Capacity Team studies are in progress. Table 2-2 provides the status of the program at the airports with Airport Capacity Design Teams, and Figure 2-1 shows the location of each of these airports.

Figure 2-2 is a three-year plan for the Airport Capacity Design Team program. For FY93, Design Teams have been proposed for El Paso, Las Vegas, Milwaukee, Tampa, Tulsa, San Diego, and West Palm Beach. A second, follow-on study is planned for Detroit.

Table 2-2. Status of Airport Capacity Design Teams[1]

Airport Capacity Design Team Status			
Completed		**Ongoing**	**Planned**
Atlanta	Orlando	Albuquerque	El Paso
Boston	Philadelphia	Cleveland	Las Vegas
Charlotte	Phoenix	Eastern Virginia *	Milwaukee
Chicago	Pittsburgh	Ft. Lauderdale	San Diego
Detroit **	Raleigh-Durham	Houston Intercont.	Tampa
Honolulu	Salt Lake City	Indianapolis	Tulsa
Kansas City	San Antonio	Minneapolis *	West Palm Beach
Los Angeles	San Francisco	Port Columbus	
Memphis	San Jose		
Miami	San Juan, P.R.		
Nashville	Seattle-Tacoma		
New Orleans	St. Louis		
Oakland	Washington-Dulles		

* Projects recently initiated
** Follow-on study planned

1. Airport Capacity Design Status as of 2-1-93.

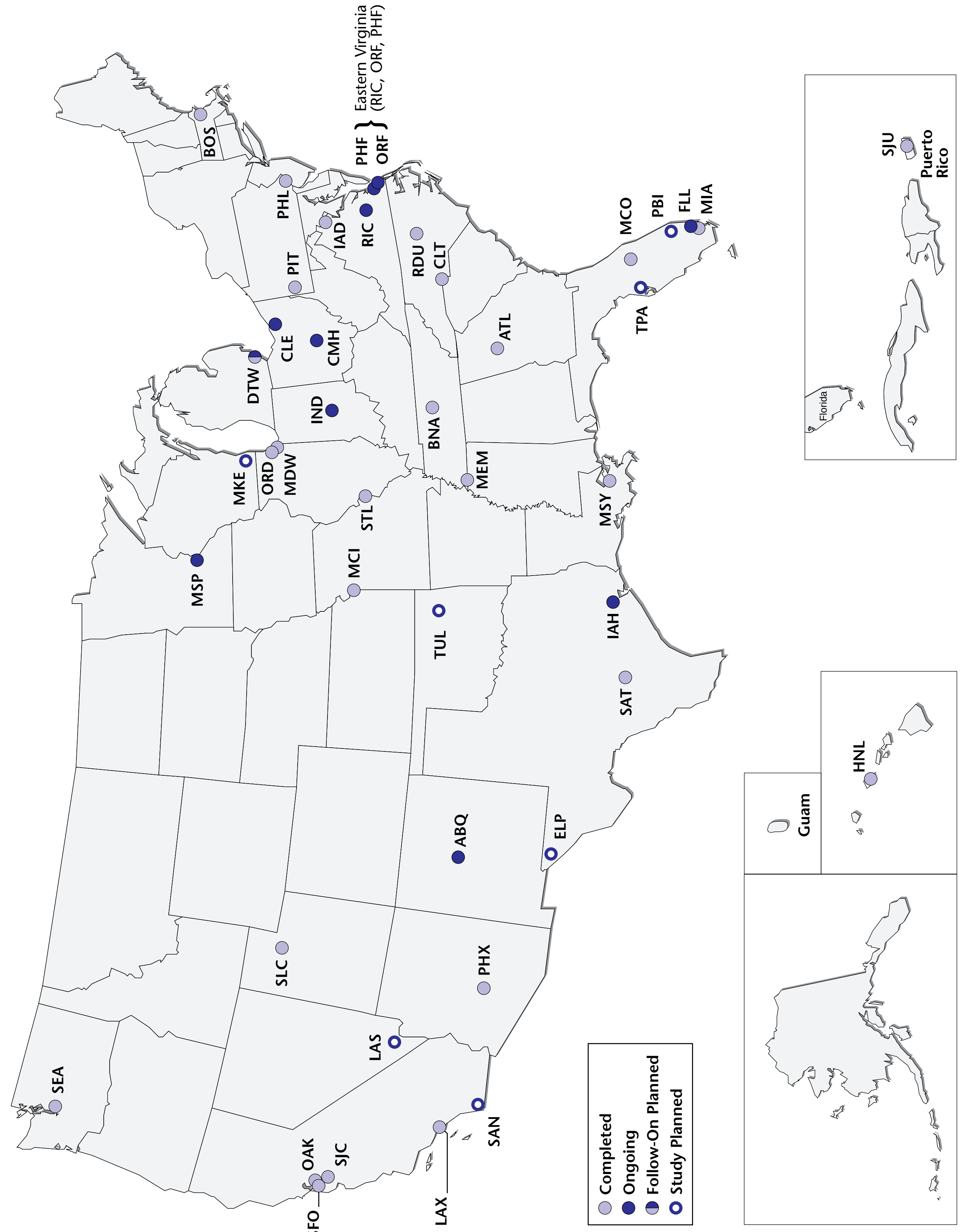

Figure 2-1. Airport Capacity Design Teams in the U.S.

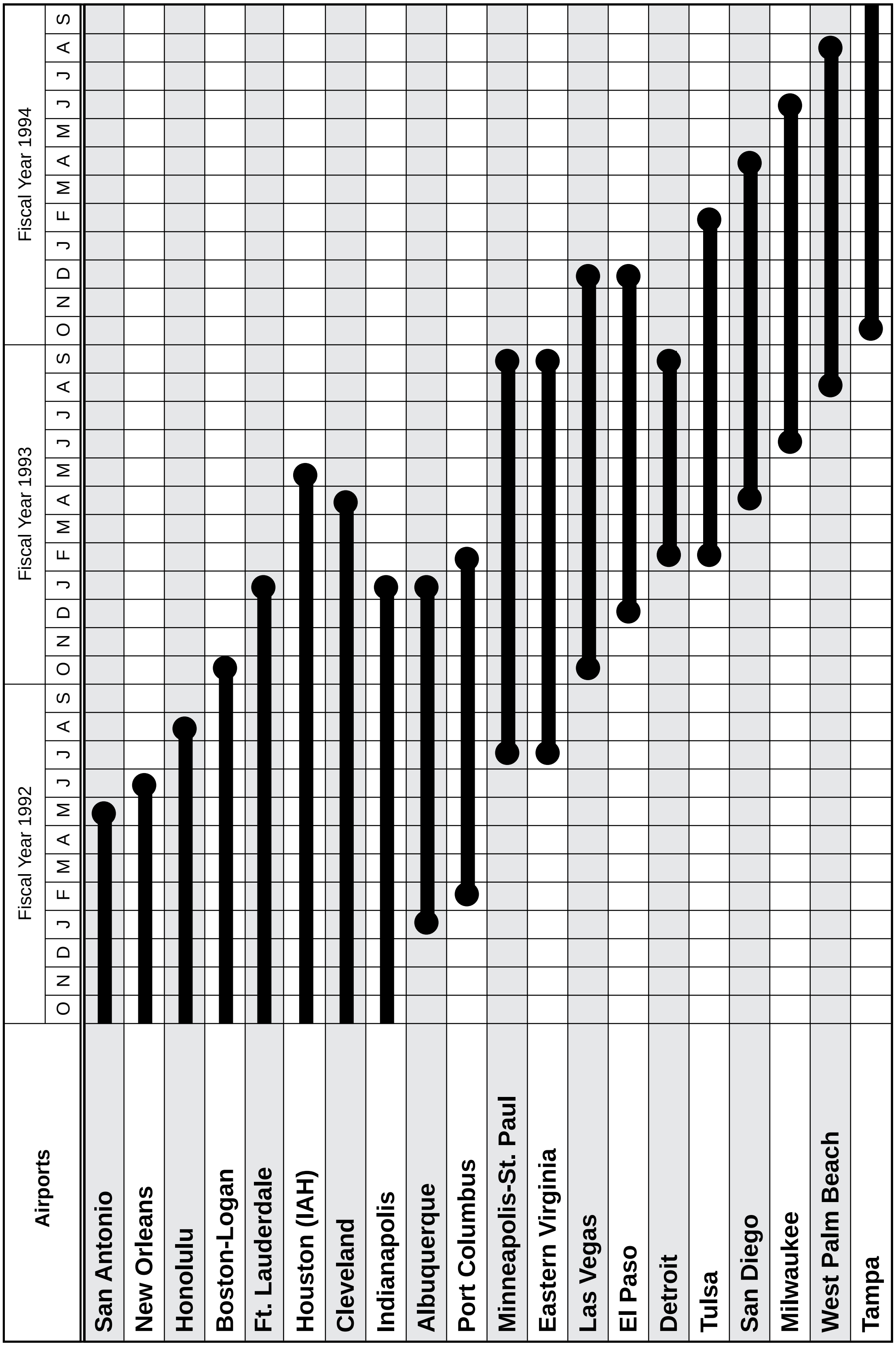

Figure 2-2. Airport Capacity Design Team — Three Year Plan

Source: FAA Office of System Capacity and Requirements

2.3.1 Airport Capacity Design Teams — Recommended Improvements

The Airport Capacity Design Teams identify and assess various corrective actions which, if implemented, will increase capacity, improve operational efficiency and reduce delay at the airports under study. These changes may include improvements to the airfield (runways, taxiways, etc.), facilities and equipment (navigation and guidance aids), and operational procedures. The capacity teams examine each alternative to determine its technical merits. Environmental, socioeconomic, and political issues are not evaluated here but in the master planning process. Alternatives are examined with the assistance of computer simulations provided by the FAA Technical Center at Atlantic City, New Jersey. In their final report, the capacity team recommends certain projects for implementation.

Airport Capacity Design Teams identify and assess various corrective actions which, if implemented, will increase capacity, improve operational efficiency and reduce delay at the airports under study.

Improvements recommended by the 26 completed studies can be divided into three categories: airfield, facilities and equipment, and operational improvements. Table 2-3 summarizes these recommendations according to generalized categories of improvements. The Airport Capacity Design Teams have developed more than 500 projects to increase airport capacity.

The Airport Capacity Design Teams have developed more than 500 projects to increase airport capacity.

Six airports are proposing to build a third or a fourth parallel runway, three are proposing to build both a third and a fourth parallel runway, five are proposing to build a new runway and a new taxiway, seven are proposing to build a new taxiway only, and one airport is proposing to build a new taxiway and new third and fourth parallel runways. Over half the design team reports have recommended runway extensions, taxiway extensions, angled/improved exits, or holding pads/improved staging areas.

The only facilities and equipment improvement that was recommended in more than half of the airport studies was the installation or upgrade of Instrument Landing Systems (ILSs) at one or more runways or runway ends, thus improving runway capacity during IFR operations.

The operational improvements that were recommended in half or more of the studies include improved IFR approach procedures and reduced separation standards for arrivals. Approximately one-third of the studies recommended an airspace analysis or restructuring of the airspace. Greater use of reliever airports was recommended at almost half of the airports.

Capacity Team recommendations demonstrate the FAA's efforts to increase aviation system capacity by making the most use of current airports.

In general, the Capacity Team recommendations demonstrate the FAA's efforts to increase aviation system capacity by making the most use of current airports. In the view of the Airport Capacity Design Teams, the "choke point" most often is found in the runway/taxiway system. Where possible, the construction of a third and even a fourth parallel runway has been proposed. Runway and taxiway extensions, new taxiways, and improved exits and staging areas have been recommended to reduce runway occupancy times and increase the efficiency of the existing runways. In addition to maximizing use of airport land, airports are making the best use of facilities, equipment, and procedures to increase arrival capacity during IFR operations. Equipment is being installed to accommodate arrivals under lower ceiling and visibility minima, including ILSs, RVRs, and improved radar, not to mention new and improved arrival procedures and reduced separation standards, both in-trail and laterally, for arrivals. Finally, in an effort to segregate larger jets from small/slow aircraft, the FAA is recommending improved use of reliever airports for general aviation and commuter traffic.

Table 2-3. Summary of Capacity Design Team Recommendations

Recommended Improvements / Airports	Atlanta	Boston	Charlotte-Douglas	Chicago Midway	Chicago O'Hare	Honolulu	Kansas City	Los Angeles	Memphis	Miami	Nashville	New Orleans	Oakland	Orlando	Philadelphia	Phoenix	Pittsburgh	Raleigh-Durham	St. Louis	Salt Lake City	San Antonio	San Fransisco	San Jose	San Juan, Puerto Rico	Seattle-Tacoma	Washington-Dulles
Airfield Improvements																										
Construct third parallel runway			√			√	√		√						√	√		√	√	√	√	√			√	√
Construct fourth parallel runway							√				√			√			√	√				√			√	
Relocate runway					√						√				√			√								
Construct new taxiway	√	√		√	√			√	√	√	√	√	√	√		√		√			√			√		√
Runway extension		√	√	√	√	√		√	√		√				√		√				√	√	√			√
Taxiway extension		√	√				√	√	√	√	√			√		√			√	√	√	√		√		√
Angled exits/improved exits	√	√	√		√	√	√		√	√			√			√		√	√	√		√	√	√	√	
Holding pads/improved staging areas	√	√	√	√	√	√	√	√		√	√		√	√		√		√	√	√	√	√	√	√		√
Terminal expansion	√					√	√	√								√	√			√				√		√
Facilities and Equipment Improvements																										
Install/upgrade ILSs	√	√	√		√	√	√	√	√	√	√			√		√	√	√	√	√	√				√	
Install/upgrade RVRs	√						√			√								√		√	√					√
Install/upgrade lighting system	√		√							√						√			√	√	√			√		√
Install/upgrade VOR												√		√		√								√		
Upgrade terminal approach radar	√																									
Install ASDE	√		√				√			√				√				√	√	√						
Install PRM			√											√	√		√			√	√					
New air traffic control tower								√				√												√		
Wake vortex advisory system	√	√									√							√	√		√			√	√	
Operational Improvements																										
Airspace restructure/analysis								√			√	√		√	√		√	√			√					
Improve IFR approach procedures		√		√	√		√		√	√	√	√		√	√	√		√	√	√	√				√	√
Improve departure sequencing															√	√						√	√			
Reduced separations between arrivals	√			√			√		√			√				√		√	√	√	√			√	√	√
Intersecting operations with wet runways		√	√		√																					
Expand TRACON/Establish TCA			√								√							√								
Segregate traffic														√		√										
De-peak airline schedules	√					√	√		√		√					√			√			√			√	√
Improve use of reliever airports			√			√				√	√	√		√		√				√	√	√		√		√

2.3.2 Airport Capacity Design Teams — Potential Savings Benefits

As can be seen from the summary of recommendations in Table 2-3 and the detailed listing of recommendations in Appendix C, the typical design team will make 20 to 30 recommendations for improvements to reduce delay at each airport. Because of the large number of specific improvements, it is virtually impossible to summarize the expected benefits of each of these recommendations for all of the airports in a single table. However, in many cases, the recommended improvements to the airfield represent the biggest capacity gains, particularly since they frequently incorporate the benefits of improved procedures and upgraded navigational equipment.

Table 2-4 summarizes the potential delay savings benefits from the airfield improvements recommended by the Airport Capacity Design Teams. These savings benefits were drawn from the final reports of various Capacity Teams. Delay savings are stated in millions of dollars and thousands of hours of delay saved at the highest future demand level considered by the design team. A breakdown of the summarized material and additional information is contained in Appendix F of this report.

Table 2-4. Potential Savings from Airfield Improvements Recommended by Airport Capacity Design Teams [2]

Airport Design Team	Major Recommended Improvements	Demand		Savings	
		Baseline	Highest	Hours (000)	Dollars ($M)
Atlanta	Fifth concourse, commuter/GA terminal and runway complex	750,000	796,500	147.0	$220.5
Charlotte	Third and fourth parallel runways	430,000	600,000	92.6	$129.7
Detroit	Two new runways	409,000	600,000	227.4	$412.9
Kansas City	Four new runways, high speed runway exits	212,000	450,000	185.8	$192.0
Memphis	New runway, taxiway extension, angled runway exit	382,000	510,000	51.5	$85.5
Miami	New taxiways, taxiway extension, improved runway exits, new holding areas	326,825	532,700	—	$41.0
Orlando	Fourth runway, new taxiways, staging areas	294,000	600,000	—	$59.6
Phoenix	New runway, new taxiways, holding area, angled exits, widened fillets	465,000	650,000	944.7	$1,020.3
St. Louis	Two new runways, taxiway extensions, angled runway exits	530,000	740,000	2,227.0	$3,294.0
Salt Lake City	New runway, revised taxiway exits	269,600	418,000	65.8	$71.7
Seattle-Tacoma	New runway, new taxiways, high speed exits	320,000	425,000	436.4	$628.4
Washington Dulles	Two new runways	320,000	450,000	14.6	$19.9

2. The potential annual delay savings in hours and dollars shown in the table represent the sum of the estimated savings benefits of the major recommended improvements for each airport. However, the savings benefits of these individual alternatives are not necessarily additive. They have been totaled here only to give an approximation on a single page of the impact these improvements could have in reducing delay at these airports.

It should also be noted that the particular combination of computer models and analytic methods used to calculate the annual delay costs and benefits is unique to each airport. Therefore, it is difficult, if not impossible, to compare one airport to another.

2.4 Construction of New and Extended Runways

The construction of new runways and extension of existing runways are the most direct and significant actions that can be taken to improve the capacity at existing airports. Large capacity increases, under both visual flight rules (VFR) and instrument flight rules (IFR), come from the addition of new runways that are properly placed to allow additional independent arrival and/or departure streams. The resulting increase in capacity is from 33 percent to 100 percent (depending on whether the baseline airport has a single, dual, or triple runway configuration.)

Sixty-two of the top 100 airports have proposed new runways or runway extensions to increase airport capacity.[3]

Seventeen of the 23 airports exceeding 20,000 hours of air carrier flight delay in 1991[4] are in the process of constructing or planning the construction of new runways or extensions of existing runways.

Of the 33 airports that are forecast to exceed 20,000 hours of annual air carrier delay in 2002, if no further improvements are made, 25 propose to build new runways or runway extensions.[5]

The total anticipated cost of completing these new runways and runway extensions exceeds $7.7 billion. The proposed projects are in various stages of development. Of the 114 known projects, 77 are shown on an approved airport layout plan (ALP), 26 are known to have completed an environmental impact statement (EIS), 15 are known to have completed an application for an Airport Improvement Program (AIP) grant, and 14 have already begun construction.[6]

New parallel runways were put into service at Cincinnati, Indianapolis, Las Vegas, and Little Rock in 1990 and 1991. All runway extensions at Baltimore-Washington became operational in 1990, and a runway at Cleveland was reconstructed. Figure 2-3 shows which of the top 100 airports are planning new runways. Figure 2-4 shows which of the airports forecast to exceed 20,000 hours of annual delay in 2002 are planning new runways. Table 2-5 shows new and extended runways that are planned or proposed.

The "generic" hourly IFR capacities included in Table 2–5 have been developed only to provide a common basis for comparing one airport configuration to another. They serve to illustrate the size of the capacity increases provided. These generic estimates should not be taken as the exact capacity of a particular airport.

The construction of new runways and extension of existing runways are the most direct and significant actions that can be taken to improve the capacity at existing airports. The resulting increase in capacity is from 33 percent to 100 percent.

Sixty-two of the top 100 airports have proposed new runways or runway extensions to increase airport capacity.

Seventeen of the 23 airports exceeding 20,000 hours of air carrier flight delay in 1991 are in the process of constructing or planning the construction of new runways or extensions of existing runways.

3. The airports having runway projects are pictured in Figure 2-3 and summarized in Table 2-5, with the projected IFR capacity benefit, the estimated project cost (to the nearest million), and an estimated operational date. The single figure of IFR capacity benefit does not reflect all of the many significant capacity benefits resulting from this new construction, but it does provide a common benchmark for comparison.
4. At a cost of $1,600 in airline operating expenses per hour of airport delay, 20,000 hours of flight delay translates into over $32 million per year.
5. As reflected in Figure 2-4.
6. As reflected in Table 2-5 and Appendix D.

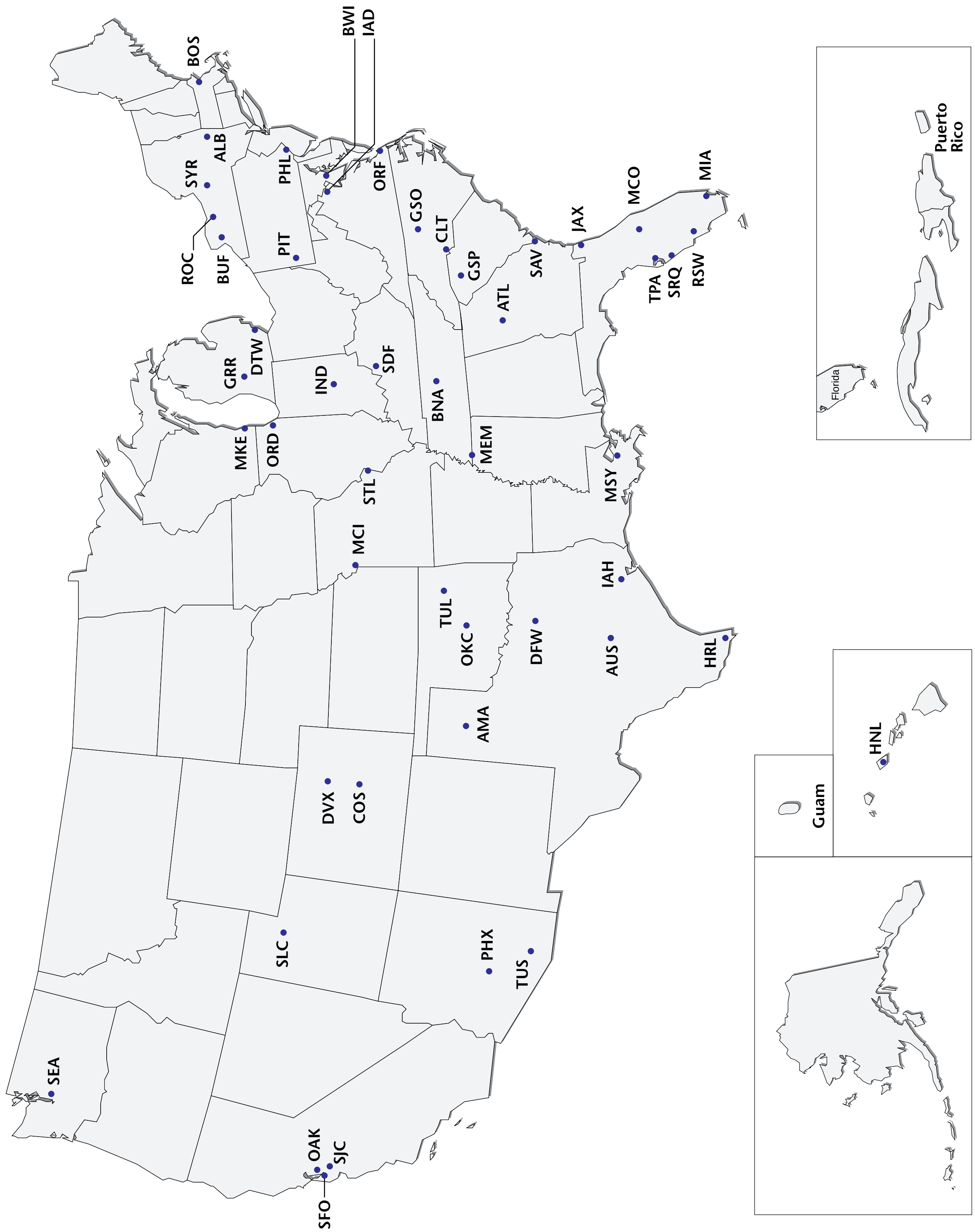

Figure 2-3. New Runways Planned or Proposed Among the Top 100 Airports

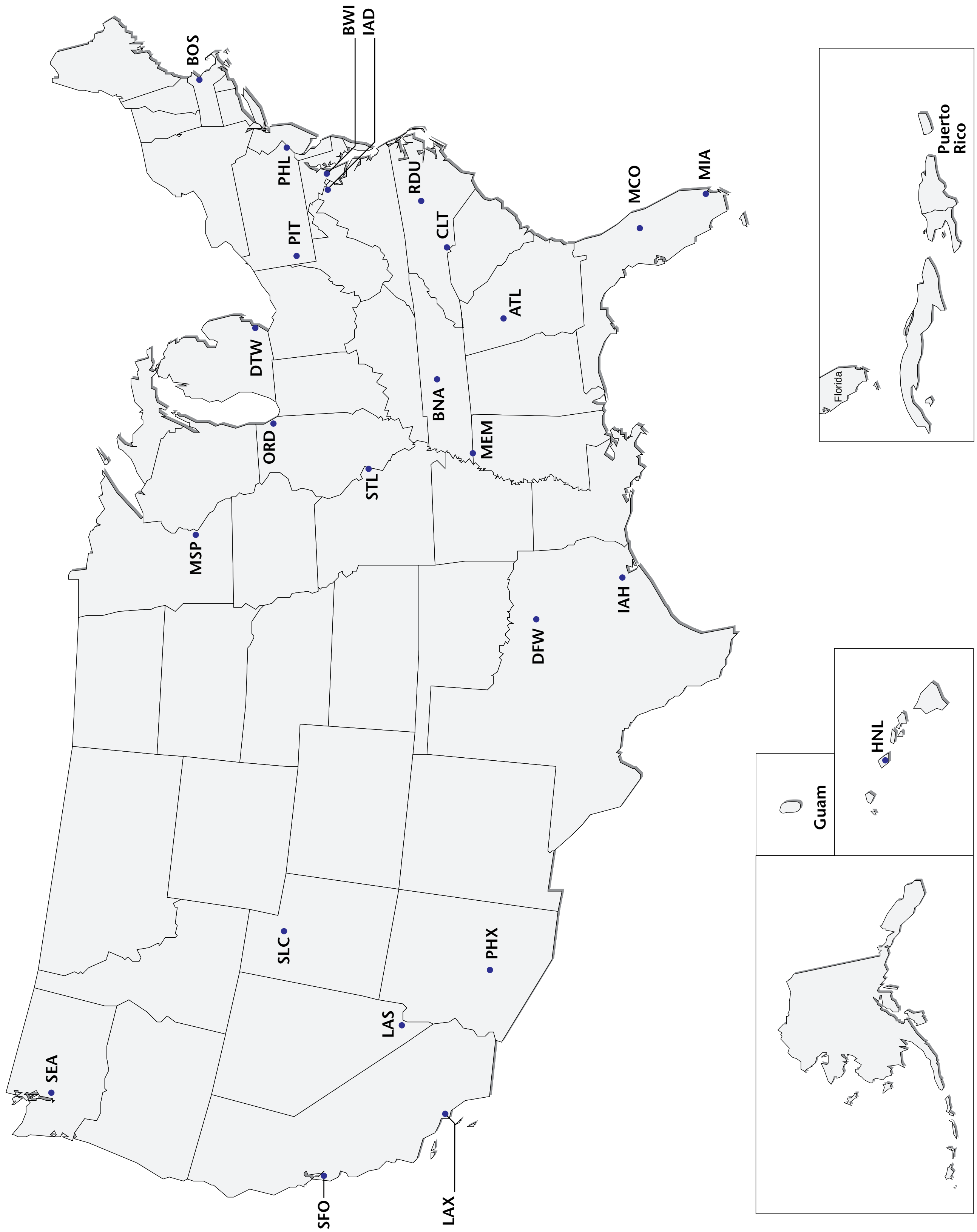

Figure 2-4. New Runways or Extensions Planned/Proposed Among the Top 100 Airports Forecast to Exceed 20,000 Hours of Annual Aircraft Delay in 2001

Table 2-5. New and Extended Runways Planned or Proposed[+]

Airport	Runway	IFR Capacity (ARR/HR)[†] New Config.	Current Best	Est. Cost ($M)	Est. Date Oper.
Albany (ALB)	10/28 extension	29[2]	29[2]	$2	1997
	1R/19L parallel	++	29[2]	$15	2007
Albuquerque (ABQ)	3/21 extension	29[2]	29[2]	$11	1994
Amarillo (AMA)	13/31 extension	++			1997
Atlanta (ATL)	E/W parallel	71[6]	57[1]	$130	1996
Austin New Airport (AUS)	(Bergstrom AFB)	57[11]			1997-8
Baltimore (BWI)	10R/28L parallel	57[11]	29[2]	$48	1996
Birmingham (BHM)	18/36 extension	29[2]	29[2]	$43	1995
Boston (BOS)	14/32	57[11]	29[2]		
	15L extension	29[2]	29[2]		
Buffalo (BUF)	5L/23R parallel	29[2, 8]	29[2, 8]		1999
	14/32 extension	29[2, 8]	29[2, 8]	$4	1999
Charlotte (CLT)	18L/36R extension	57[7, 8]	57[1, 2]	$8	1994
	18W/36W parallel	86[3, 10]	57[1, 8]	$40	1997
	18E/36E parallel	114[10]	57[1, 8]		
Chicago O'Hare (ORD)	9/27	86[3]	57[1]		
	14/32	86[3]	57[1]		
Cincinnati (CVG)	18R/36L extension	57[1]	57[1]		
Cleveland-Hopkins (CLE)	5L/23R replacement	42[4]	29[2]	$42	1998
	5L extension	29[2]	29[2]	$10	1998
Colorado Springs (COS)	17L/35R parallel	57[1]	29[2]	$38	1992
Columbus (CMH)	10L/28R replacement	57[7]	42[4]	$48	1995
Dallas-Fort Worth (DFW)	17R/35L extension	57[1]	57[1]	$24	1993
	17L/35R extension	57[1]	57[1]	$24	
	18L/36R extension	57[1]	57[1]	$24	1994
	18R/36L extension	57[1]	57[1]	$24	
	16E/34E	86[3, 10]	57[1]	$110	1996
	16W/34W	114[10]	57[1]	$70	1997-99
Dayton (DAY)	6L extension	57[1]	57[1]	$3	1998
Denver Int'l (DIA)	New airport	86[3, 10]	57[1]	$2,972**	1993
Des Moines (DSM)	5/23 extension	29[2]	29[2]	$61	1998
	13R/31L parallel	57[11]	29[2]	$150	2012
Detroit (DTW)	9R/27L parallel	57[1]	57[1]	$85	1993
	4/22 parallel	71[6]	57[1]	$90	1998
Fort Lauderdale (FLL)	9R/27L extension	57[1]	29[2]	$96-$263	2000
Fort Myers (RSW)	6/24 extension	29[2]	29[2]	$23	1994
	6R/24L parallel	57[1]	29[2]	$139	1999
Grand Rapids (GRR)	17/35 replacement	57[1]	29[2]	$46	1997
	8L/26R extension	29[2]	29[2]	$2	1993

Table 2-5. New and Extended Runways Planned or Proposed[+]

Airport	Runway	IFR Capacity (ARR/HR)[†] New Config.	Current Best	Est. Cost ($M)	Est. Date Oper.
Greensboro (GSO)	5L/23R parallel	57[1]	29[2]	$20	2010
	14/32 extension	29[2]	29[2]		
Greer (GSP)	3R/21L parallel	57[1]	29[2]	$25	1999
	3L/21R extension	29[2]	29[2]	$12	1995
Harlingen (HRL)	13L/31R parallel	57[7]	29[2]	$5	1995-2000
	13/31 extension	29[2]	29[2]	$7	1995
Houston (IAH)	8L/26R parallel	86[3]	57[1]	$44	1999
	9R/27L parallel	57[1]	57[1]	$44	2002
	14R/32L extension	57[1]	57[1]	$8	1997
Indianapolis (IND)	5L/23R replacement	57[1]	42[4]	$42	1996
Islip (ISP)	6/24 extension	29[2]	29[2]		
Jacksonville (JAX)	7R/25L parallel	57[1]	29[2]	$37	
	7L/25R extension	29[2]	29[2]	$10	1995
Kansas City (MCI)	1R/19L parallel	57[1]	29[2]	$46	1992
	9R/27L parallel	29[2]	29[2]	$60	1999
	18L/36R parallel	57[1]	29[2]	$65	2005
	18R/36L parallel	86[3]	29[2]	$90	2015
Las Vegas (LAS)	1L/19R extension	29[2]	29[2]		1997
Los Angeles (LAX)	6L/24R paved overrun	57[1]	57[1]	$4	1997
Louisville (SDF)	17R/35L parallel	57[1]	29[2]	$125	1995
	17L/35R parallel	29	29[2]	$125	1996
Lubbock (LBB)	8/26 extension	29[2]	29[2]	$6	1995
Memphis (MEM)	18L/36R parallel	57[7]	42[4]	$105	1995
	18L/36R extension	42[4]	42[4]	$10	1997
Midland (MAF)	10/28 extension	57[7]	29[2]	$11	1995
Milwaukee (MKE)	7R/25L parallel	57[7]	29[2]	$150	2003
	1L/19R extension	29[2]	29[2]	$13	1995
Minneapolis (MSP)	4/22 extension	29[2]	29[2]	$15	1994
Nashville (BNA)	2C/20C extension	57[1]	57[1]	$34	1994
	13/31 extension	57[1]	57[1]		1994
	2E/20E parallel	++	57[1]	$150	
	2R/20L extension	57[1]	57[1]		
	2L/20R extension	57[1]	57[1]		
New Orleans (MSY)	1L/19R parallel	57[1]	29[2]	$160	2000
	10L/28R parallel	29[2]	29[2]	$40	1995
	10S/28S parallel	57[1]	29[2]		2000
Norfolk (ORF)	5R/23L parallel	29[2]	29[2]	$13	1994
	14/32 extension	29[2]	29[2]	$2	1996
Oakland (OAK)	11R/29L parallel	++	29[2]	$143	2020

Table 2-5. New and Extended Runways Planned or Proposed+

Airport	Runway	IFR Capacity (ARR/HR)† New Config.	Current Best	Est. Cost ($M)	Est. Date Oper.
Oklahoma City (OKC)	17L/35R extension	57[1]	57[1]	$24	2001
	17R/35L extension	57[1]	57[1]	$20	2001
	17/35 parallel	57[1]	57[1]	$55	2001
Orlando (MCO)	17L/35R 4th parallel	86[3]	57[1]	$100	1997
Philadelphia (PHL)	8/26 parallel-commuter	57[1]	57[7]	$169	1997
	17/35 extension	57[1]	57[7]	$17	
	relocate 9L/27R	57[1]	57[7]	$109	1997
Phoenix (PHX)	8S/26S 3rd parallel	57[1]	29[2]	$88	1995
Pittsburgh (PIT)	10C/28C extension	57[1]	57[1]	$10	1995
	4th parallel 10/28	86[3]	57[1]	$100	1996
	14R/32L		57[1]	$100	1995
Raleigh-Durham (RDU)	Relocate 5R/23L	57[1]	42[4]	$37	1996
	5W/23W	++	42[4]	$75	
	5E/23E	++	42[4]	$75	
Rochester (ROC)	4R/22L parallel	++	29[2]	$5	1997
	4/22 extension	57[7]	29[2]	$1	1996
	10/28 extension	57[7]	29[2]	$2	1994
St. Louis (STL)	12L/30R	++	29[2]	$95	
Salt Lake City (SLC)	16/34 west parallel	71[6]	42[4]	$235	1995
San Jose (SJC)	12L/30R extension	29[2]	29[2]	$8	1993
Sarasota-Bradenton (SRQ)	14L/32R parallel	29[2]	29[2]	$10	1996
	14/32 extension	29[2]	29[2]	$4.5	1995
Savannah (SAV)	9L/27R parallel	57[1]	29[2]	$20	2010
	9R/27L extension	29[2]	29[2]	$7	1997
	18/36 extension	29[2]	29[2]	$4	1995
Seattle-Tacoma (SEA)	16W/34W parallel	42[4]	29[2]	$300	2005
Spokane (GEG)	3L/21R	57[1]	29[2]	$11	2000
Syracuse (SYR)	10L/28R	57[1]	29[2]	$5	1997
Tampa (TPA)	18R/36L 3rd parallel	57[1]	57[1]	$53	1997
Tucson (TUS)	11R/29L parallel	29[2]	29[2]	$143	1997
Tulsa (TUL)	17E/35E parallel	86[3]	57[1]	$100	1998
Washington (IAD)	1W/19W parallel	86[3]	57[1]	$60	2000
	12/30 parallel	57[1]	57[1]		
	12/30 extension	57[1]	57[1]	$12	1992
West Palm Beach (PBI)	9L/27R extension	29[2]	29[2]	$5	1998
	13/31 extension	29[2]	29[2]	$5	1995

Total Available Estimated Costs of Construction: $7.8-7.9 Billion*

+ See endnotes 1-11, below, which describe the IFR arrival capacity of the current and potential new configurations.

++ Information on runway location is unavailable or too tentative to determine IFR multiple approach benefit of this new construction project.

* Includes the total costs of the New Denver airport, $2,972 million. Does not include the cost of projects completed in 1991.

† Estimates of generalized hourly IFR arrival capacity increases are included in Table 2–5. These values have been updated from those originally reported in a 1987 report. The new numbers reflect the approval of 2.5 {for wet runways inside 10 nm}, 3, 4, 5, and 6 nm in-trail separations and 1.5 nm diagonal separation for dependent parallel arrivals. The updated IFR arrival capacity of any single runway that can be operated independently is 29 arrivals per hour (rounded up from 28.5); dependent parallel runways, 42 arrivals per hour; and independent parallels, 57 arrivals per hour (2 times a single runway, 28.5). Other configurations are multiples of the above. These values are provided to illustrate the approximate magnitude of the capacity increase provided. They should not be taken as the exact capacity of a particular airport, since site-specific conditions (e.g., varying aircraft fleet mixes) can result in differences from these estimates.

Endnotes

1. Independent parallel approaches [57 IFR arrivals per hour].
2. Single runway approaches [29 IFR arrivals per hour {rounded up from 28.5}].
3. Triple approaches (currently not authorized) [86 IFR arrivals per hour {rounded up from 85.5}].
4. Dependent parallel approaches [42 IFR arrivals per hour].
5. Triple approaches with parallel and converging pairs may permit more than 57 IFR arrivals if procedures are developed.
6. Triple parallel approaches with dependent and independent pairs (currently not authorized) [71 IFR arrivals per hour {This is a rough estimate, obtained by adding 42 & 29 as explained above}].
7. Converging IFR approaches to minima higher than Category (CAT) I ILS [57 IFR arrivals per hour].
8. Added capacity during noise abatement operations.
9. Independent parallel approaches with one short runway.
10. If independent quadruple approaches are approved [114 IFR arrivals per hour].
11. Independent parallel approaches (3,400 ft. to 4,300 ft.) [57 IFR arrivals per hour].